



Newsletter

September 2005 No. 118

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***Incorporating
The
Mineralogical
Society of
New Zealand***

* * * *

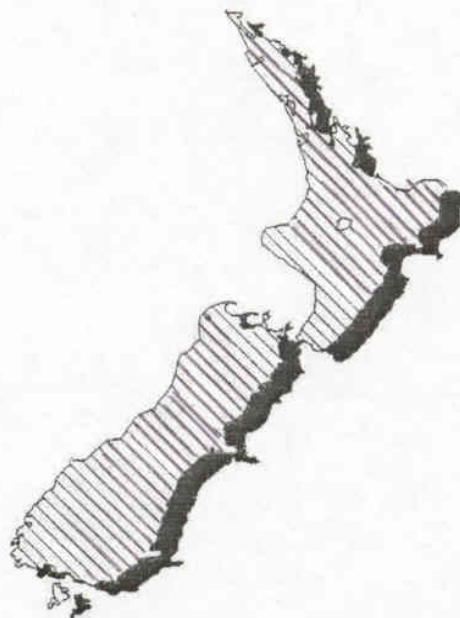
The NZ Geochemical Group web page (thanks to Dave Craw and Otago University) is at:

<http://www.otago.ac.nz/geology/nzgg/nzgg.html>

"I see the Geochemical Group as part of the New Zealand scientific community, that is the scientists of the Universities, Government and private enterprise. The prime purpose of this newsletter is to foster communication between members of this community who have an interest in geochemical work in common.

Success of the Newsletter depends on all members being contributors. Let us hear, therefore, about your research and your views of the development and aims of the group. There should be plenty of material, as studies in applied, compositional, isotope, mineral phase equilibria, organic and solution geochemistry are in progress and New Zealand is an excellent natural laboratory for such investigations."

J. Rogers, first Chairman of the New Zealand Geochemical Group, in his Introduction to the first issue of the Newsletter, November 1965.



N.Z. Geochemical Group Newsletter is issued to members of the Group to keep them in touch with New Zealand geochemistry. Material in the Newsletter should not be referred to in scientific papers without the permission of the author.

c/o G.L. Lyon, 32 Britannia St, Petone, New Zealand

NEW ZEALAND GEOCHEMICAL GROUP 2005 - 2007

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NEWSLETTER EDITOR :

Editor-in-Chief and Distribution Organiser: Dick Glover. Contact above as for Treasurer

NEXT ISSUE: Contributions please to: **Dick Glover**

2005 – 2007 S U B S C R I P T I O N S

NOW DUE !!

NOW DUE !!

The Group welcomes anyone with an interest in geochemistry.

Subscriptions for 2005-2007 are NOW DUE as follows

New Zealand members	NZ \$ 8.00 for 2 years
or	NZ \$60.00 life membership
Overseas members	NZ \$12.00 for 2 years
or	NZ \$90.00 life membership
New Zealand libraries	NZ \$10.00 for 2 years
Overseas libraries	NZ \$14.00 for 2 years

[Overseas payments should be in NEW ZEALAND DOLLARS by bank cheque, postal note or international money order.]

Subscriptions should be sent to **Dr R.B. Glover,**
Hon. Treasurer, N Z Geochemical Group,
33c Brandon Road,
Glen Eden,
Auckland, NEW ZEALAND.

Editor's Note:

My **last issue** as editor.

Looking at the old newsletters, I see I took over from Watson Kitt as distribution manager in No 67, July 1983. I think that the previous editor Werner Giggenbach was last in charge for a newsletter with about No 80! After he resigned as sole editor, it was rotated often, but I seemed to end up coordinating the editors, and often assembling newsletters myself, so that at the BGM in 1993, I was appointed Editor in Chief, according to the BGM minutes. So: I've been involved in about 50 issues, some of them only as distributor, some like this issue, wholly editing and distributing, and some as a coordinator for others to edit. It's been always interesting and rewarding to see what's happening in geochemistry in New Zealand. I hand over to Dick Glover so I'm sure the newsletter will be in good hands.

Thank you all for your support to the group and the recent conference at Orakeikorako reaffirmed the Group as an independent organisation.

Thank you to Chris Hendy, Annie Barker and helpers at Waikato University for the wonderful organisation and a pleasant environment for the conference. I joined the Otago geologists at Rotorua airport after I had driven up from Lower Hutt, then we met Waikato and other people at Lake Rotorua. They had travelled from Hamilton via some field stops. Chris Hendy took a group of us on a tour to Mokoia Is. on the boat provided by a local benefactor – a businessman putting money and help into research to try and save the Rotorua Lakes. The geological, anthropological and geothermal matters of interest on the island and the environmental studies on the lake were well explained to us. The field trip then went on to a quick tour of the Waiotapu Geothermal area, just arriving in time before the gates closed for the day. Then on to Orakei Korako. The conference program follows later in the newsletter. It was unfortunate that the weather packed up with vigorous southerly arriving on the Thursday morning with subsequent cancellation of the planned White Is. tour.

Note too, that we now have a new web address (see cover), and there may be more and more information there!

Please also, if you could receive this newsletter by email, rather than snail-mail (and do not already), please let Dick know. It will save time and money from all involved in the production and distribution.

Graeme Lyon

Introducing :

The New President Jonathon Kim

Although it has been traditional that the presidency of our august organization has been foisted, almost by default, on an unsuspecting person (sometimes not even present at our biannual meetings), it is an honour to be elected as President of the New Zealand Geochemistry Group at our conference held at Orakeikorako this past July. I look forward to hosting a great conference in Dunedin in a year and a half's time (during 2007) and to seeing all of you here in Dunedin.

A little background about who I am. I was born and bred in the United States of America (my parents are both from Hawaii). During my childhood days, I grew up as an "army brat", as my father was a sergeant in the United States Army, and lived in various states in America and also in several parts of what was then known as West Germany. I graduated from an "average" public high school in New

Jersey, and earned a Bachelor of Arts in Chemistry at Reed College in Portland, Oregon. After obtaining a Master of Science in Earth Science from the University of New Hampshire, I completed a Doctorate degree in Oceanography from the University of Connecticut with William F. Fitzgerald, looking at the volatilization and sea to air exchange of mercury to the atmosphere.

During this time, as a graduate research assistant, I first experienced New Zealand, working on the Sea Air Exchange (SEAREX) experiment held at Ninety Mile Beach which was funded by the National Science Foundation of the United States. This involved sampling air for various chemicals transported from the continents to the open ocean from a 20 metre tower constructed down on the beach. Our sampling pumps and other scientific gear were powered by a diesel generator supplying “American ” (120 V, 60 Hz) electricity. We were based in a caravan village that surrounded the shearers’ quarters at Te Paki sheep station (then a Landcorp farm) and drove down Te Paki stream everyday. We must have pulled out at least 60 cars over a 3 month period from the “quick sand” in the stream. It was there along the shore near Pandora that I visited the most lovely cove I have ever seen and first fell in love with New Zealand. I also met Chris Hendy for my first time as he came up to visit with a group of his students on one of his “now famous” field trips.



I secured a post-doctoral fellowship at the University of Otago for a few years with Keith Hunter, looking at the marine chemistry of Doubtful Sound. At the end of this time, I spotted an advertisement in the Otago Daily Times for a position in geothermal chemistry at Wairakei and put in an application. However, my time in Dunedin had run out and thinking I was leaving New Zealand for “good” for my second time, I left for a very long holiday in Hawaii. I was pleasantly surprised to gain an interview for the Wairakei position, where Kevin Brown hired me on the spot. By the time I arrived to work in the Chemistry Division of DSIR at Wairakei, Kevin had moved on, but I had a delightful year and a half living in Taupo. My work there concerned geothermal and volcanic chemistry. I worked on a project using SF₆ as a geothermal tracer in the Wairakei geothermal field with Dick Glover and also looked at mercury in hot springs and volcanic fumaroles with Bruce Christenson. There, I also had the pleasure of getting to know Ed Mroczek and Mike Crump; as well as David Grant-Taylor, Reiner Goguel, John Patterson, Doug Sheppard, and others based at the Gracefield campus.

After the traumatic demise of DSIR, I found myself working for the next 2 years at NIWA in Hamilton, mainly investigating methyl mercury and mercury bioaccumulation in trout and the trout food web in several Rotorua lakes. Due to “growing pains” at NIWA and disrupted government funding, I finally fled back to the Dunedin, where I have been working as a FRST funded research fellow (and natural philosopher in residence) with Keith Hunter in the Chemistry Department at the University of Otago. I enjoy living here in New Zealand and as Dick Glover said of himself, I too am a Kiwi by choice.

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New Web Page

Thanks to Dave Craw and Stephen Read of Otago University and Elizabeth McKenzie, a new web site has been set up and users of the previous one are now redirected automatically. The site is: <http://www.otago.ac.nz/geology/nzgg/nzgg.html>

19th New Zealand Geochemical Group Conference

Incorporating the New Zealand Mineralogical Society 2003

Orakei Korako Resort

June 27-30, 2005



Program:

Sunday 26th June 2005

Arrival and Ice-breaker and Dinner
(after Lake Rotorua, Mokoia Is., and Waiotapu field trip)
[Picture: Chris Hendy – boat captain, by GLL]



Monday 27th June

Opening Session

9.15 Chris Hendy Welcome by President followed by his
Keynote Address:

Advances in analytical capacity and
environmental awareness - A coming of age for
environmental geochemistry

Morning tea

Environmental Geochemistry

10.30 Jonathon Kim Dissolved mercury in South Island lakes

11.00 Penny Cooke Stable isotopes and sediments - What are they telling us about regional
abrupt climate change



Minerals

11.30 Rod Martin Secondary minerals of Rahu Rahu
and Ruatapu Caves [Picture: Rod in Rahu Rahu Cave with Alun
Baines and Chris Hendy, by GLL]

12.00 Lunch

Tour of Orakei Korako Geothermal Area

Afternoon tea

Environmental Geochemistry

3.45 Laura Haffert & Dave Crow Dissolution and attenuation
of arsenic at an historic quartz vein gold mine Waiuta, New Zealand

4.15 Kathleen Dabell, John Hadfield, Chris Hendy & Nick Kim Impact on an effluent plume from
cessation of effluent discharge

Antarctica

4.30 Tom Whittaker Former depositional environments and lake-level changes in Fryxell Basin,
Antarctica

Dinner followed by Antarctic slide show

Tuesday 28th June: Geothermal

9.00 Colin Harvey Activities in Geothermal at G N S

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9.30 Bruce Mountain, Kim Hardley & Simon Jackson Life on the edge: microbes, metals and minerals in New Zealand's geothermal systems

10.30 Morning tea

11.00 Ed Mroczek, Mike Stewart, Brad Scott & Dougall Gordon Chemistry of the Rotorua Geothermal Field

11.30 Peter Dunfield The environmental methane cycle

12.00 Lunch



1.00 *Lake Ohakura Tours & Minerals at Ohakura Dam site* [Picture: O-K mud pools, by GLL]

Wednesday 29th June

Geothermal

9.00 Dave Crow Acid-sulfate alteration of rocks of andesitic composition in a pressure-oxidation autoclave at Macraes

Mine, Otago

9.30 Dick Glover & Tricia Scott Geothermal monitoring before and during 7 years of power generation at Ngawha, New

Zealand

10.15 Morning tea

Minerals

10.45 Carole Davies & Mat Singleton (presented by Rod Martin) Cavansite and other minerals at Aranga (Stones) Quarry, Northland

Geothermal

11.15 James Pope, D. McConchie, M. Clark & Kevin Brown Diurnal biogeochemical cycles downstream of Champagne Pool, Waiotapu

11.45 Chris Hendy How sediments influence the eutrophication of Rotorua lakes

12.30 Lunch

1.30 **Posters**

Graeme Lyon & Werner Giggenbach Extreme isotopic enrichment of methane in a New Zealand geothermal spring

Olivia Motion Identifying sources of nitrate by oxygen isotopes

Shane Carter & Chris Hendy Elemental mineral interactions of the sediments of Rotorua lakes

Carmel Mangan & Chris Hendy The chronicles of a fish called Wanda: A review of the isotopic composition of fish otoliths as a record of the isotopic composition of the environment it has experienced

Alison Leslie Why does arsenic concentrate in organisms and lake sediments?

Lisa Pearson How sulfur and oxygen isotopes can be used to identify acid mine drainage

Kathleen Dabell, John Hadfield, Chris Hendy & Nick Kim Development of an effluent plume from a waste water treatment plant

Jake Croall Lake Bonney - A Key Climatic Indicator Lake

2.30 Afternoon tea

3.00 **Biannual General Meeting**

7.00 Conference Dinner and Prizegiving

Thursday was scheduled for a White Island trip by cancelled due to bad weather.

MINUTES OF THE 19TH NZGG BIENNIAL GENERAL MEETING
Orakei Korako, 29th June, 2005

President: Chris Hendy
Acting Secretary: Graeme Lyon
Start time: 3.00 pm

Attendance: Dick Glover, Jonathan Kim, Graeme Lyon, Dave Craw, Ed Mroczek, Chris Hendy, Alun Baines, Rod Martin, Kathleen Dabell, James Pope, Carole Davies
 Apologies were received from Catherine Chague-Goff.

Minutes of the previous meeting were not read.

President's Introduction

Chris discussed the disappointing numbers at the present conference, and what publicity had been made. The incoming committee should further consider at what time of year the next conference should be held. It was felt that it needs to be able to encourage students.
 It was good to see some members of the mineralogy group attending.

Treasurer's Report

Dick Glover presented the unaudited accounts for the last 2 years (see below). The last Kaikoura conference made an unexpected surplus of about \$2000, due to more attendees and less costs than expected.

Treasurer's report accepted (Dick Glover / Jonathon Kim).

The subscription rate was considered, but as long and newsletters are mostly sent by email, it was considered no change was needed.

Election of Officers

President: Jonathon Kim - Elected by acclamation.
Secretary: Graeme Lyon - accepted nomination due to lack of other volunteers.
Treasurer: Dick Glover - agreed to re-election

It was agreed that bank signatories should be reallocated to need: 2 of either - Dick Glover, Ed Mroczek, Rod Martin and Graeme Lyon.

Newsletter Editor: Graeme Lyon, having previously declared his resignation, said he would do one more issue. Dick Glover offered to continue to edit the newsletter. Rod Martin offered to help when needed.

Hon. Auditor: Mike Stewart (continued, subject to his agreement)
Committee: Chris Hendy
 Rod Martin
 Dave Craw
 Eddie Mroczek
 James Pope
 Jenny Webster (subject to her agreement –subsequently received)

NEW ZEALAND GEOCHEMICAL GROUP

Financial Statement as at 1 June 2005

<u>INCOME</u>	\$	<u>EXPENDITURE</u>	\$
ANZ Cheque a/c 28/2/2003	2,007.47	ANZ Cheque a/c 28/2/2005	4,189.70
ANZ Serious Saver 3/11/2002	8,995.57	ANZ Serious Saver 4/05/2005	10,527.46
Interest Cheque a/c	93.59	Newsletters #113 to #117	965.75
Interest Serious Saver	969.56		
Subscriptions	657.00		
L Society of	342.33		
Conference Surplus	2,617.39		
	<u>15,682.91</u>		<u>15,682.91</u>
Accumulated Funds at 28/2/2003	11,003.04		
Total Income 2003-2005	4,679.87		
Total Expenditure 2003-2005	965.75		
Accumulated Funds at 1/6/2005	<u>14,717.16</u>		
Increase since Feb 2003	3,714.12		

NOT AUDITED

R. B. Glover
Hon. Treasurer

I have examined the accounts of the New Zealand Geochemical Group and consider that the above financial statement shows correctly the group's income and expenditure from 28th Feb 2003 to 1st June 2005.

M. K. Stewart
Hon. Auditor

NEW ZEALAND GEOCHEMICAL GROUP CONFERENCE - KAIKOURA 2003**BALANCE SHEET**

<u>INCOME</u>	\$	<u>EXPENDITURE</u>	\$
Registration Fees	8,333.00	Social nibbles etc.	307.18
		Dinner	1,260.00
		Accommodation / venue	2,375.99
		Refunds	240.00
		Field Trip Expenses	1,326.00
		Printing of Abstracts	206.44
			<u>5,715.61</u>
		Conference surplus	2,617.39
	<u>8,333.00</u>		<u>8,333.00</u>

General Business

- Website: Auckland University has declared its wish that the Group's website be removed from its server. Thanks to Elizabeth McKenzie it has been there for some years. Dave Crow offered to transfer it to the Otago University Geology Department, where he considers it more advantageous to, than a problem for, their department.
- Future of the Group: The possibility of amalgamating the group with any other organization lapsed

for need of a seconder.

3. Next Conference [The 20th !]. This will probably be in the Otago area.
4. 2009 conference. Rod Martin asked permission to negotiate with the mineralogists of Australia who have suggested a joint conference in NZ in about 4 years – agreed that he proceed.
5. Prizes. It was agreed that there be 2 student's prizes (each \$50) at this conference.

Meeting closed at 4:15pm.

Post meeting notes.....

Presentations made at the Conference Dinner following the BGM were:

Student Prizes:

Laura Haffert (Otago University) for the best student presentation

Alison Leslie (Waikato University) for the best student review

Chocolate Fish Award for the Worst Abstract: This was not awarded this year!

Apart for several missing abstracts, none appeared to deserve the award that should be made on the grounds of "Vacuity Index", suggesting that Werner Giggenbach's instigation of this award had served its purpose in improving the abstract quality.

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19th New Zealand Geochemical Group Conference

Incorporating the New Zealand Mineralogical Society 2003

Orakei Korako Resort, June 27-30, 2005

Abstracts: Part 1 underlined = speaker

Posters

Extreme isotopic enrichment of methane in a

New Zealand geothermal spring

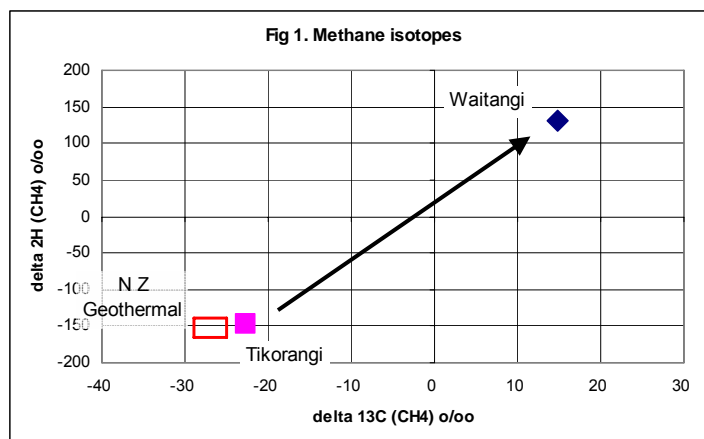
Graeme L. Lyon*, Werner F. Giggenbach**

Institute of Geological & Nuclear Sciences Ltd

PO Box 31 312, Lower Hutt, New Zealand

The methane in the gas from Waitangi Soda Spring, Taupo Volcanic Zone, New Zealand, has the heaviest recorded natural isotopic composition. The values of $\delta^{13}\text{C}_{\text{PDB}} = +14.9\text{‰}$ and $\delta^2\text{H}_{\text{SMOW}} = +126\text{‰}$

indicate that oxidation of geothermal gas from the nearby Tikorangi fumarole field has occurred. Waitangi Soda Spring is on the rim of the Haroharo Caldera of the Okataina Volcanic Centre. The spring has a temperature of 49.5C, and a high flow (about 50 kg s⁻¹) and lies between Lakes Rotoma and Rotoehu. The springs are about 3 km north of the Tikorangi geothermal area. The



Tikorangi area itself is of rather low heat output (about 0.2 MW) from solfataras with sulphur patches and temperatures up to 97C, but no liquid hot water flow. However, resistivity surveys trace a shallow outflow of hot geothermal water to the north toward Lakes Rotoehu and Rotoma. The Soda Spring gas has a high ^3He content ($^3\text{He}/^4\text{He} = 5.7$ times the atmospheric value) and is dominated by carbon dioxide, showing its geothermal origin, but differs from Tikorangi gas by having insignificant H_2S and H_2 and low CH_4 relative to CO_2 . The isotopic shifts of carbon and hydrogen are consistent with removal of about 75% of the methane (Fig 1. NZ Geothermal refers to data in *Lyon & Hulston, G.C.A. 48: 1161, 1984*). The high temperature geothermal fluid appears to have mixed with oxygen-containing groundwater, oxidising hydrogen, hydrogen sulphide and part of the methane.

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** Deceased

Identifying sources of nitrate by oxygen isotopes

Olivia Motion

University of Waikato, Private Bag 3105, Hamilton

(No abstract received, introduction and conclusions from poster follow)

Introduction:

Nitrate contamination of aquatic systems is a major health and environmental concern in New Zealand, with many areas exceeding the Maximum Acceptable Value (Environment Waikato 2005). To implement effective management plans and prevent further nitrate contamination the sources of nitrate need to be identified (Kendal 1998)

The relatively new technique of analysing the oxygen isotopic composition along with the traditional tracing method of analysing ^{15}N of nitrate can help identify the many sources of nitrate.

Conclusion:

The use of ^{15}N and ^{18}O in tracing sources of nitrate can help identify where the nitrate is coming from. ^{15}N values can be applied to nitrate sources that undergo nitrification within the soil such as organic soil nitrogen and animal and human waste. ^{18}O values can be applied for atmospheric sources such as nitrate fertiliser and identifying denitrification occurring in groundwater and riparian zones.

Elemental mineral interactions of the sediments of Rotorua Lakes

Shane Carter, Chris Hendy

Chemistry Department, University of Waikato

There are three main types of lake within the Rotorua area.

Those with;

Oxygenated waters with a slow sedimentation rate where the sediments are oxygenated, e.g. L. Tarawera.

Oxygenated waters where the sedimentation rate is fast, the high BOD results in the sediments being reduced. L. Rotorua and Okawa Bay (L. Rotoiti).

Lakes where the waters are seasonally anoxic. The sediments are cyclic, oxygenated to reducing. Lakes Okarekia, Okataina, Rotoiti and Tikitapu.

Lake sediments are also not in equilibrium. The changing conditions at the sediment - lake water interface creating a concentration difference. This concentration gradient exists between the lake waters - pore waters and then between the pore waters and the sediments.

Results from the last four years of Rotorua lakes research by University of Waikato students was used to analyse elements of the Fe-C-S- H_2O system.

Mn was included as research in the lakes shows it has correlations with Fe and mineral cycling.

There are large S inputs into some of the Lakes from volcanic and geothermal events. S was used as a marker for geothermal and volcanic events in the sediments. Arsenic was therefore included as a companion marker for the sulphur measurements. Arsenic also competes with Phosphorus.

P is a major contributor to lake eutrophication and also cycles between the lake waters and the pore waters in lakes with water anoxia.

A review of the isotopic composition of fish otoliths as a record of the isotopic composition of the environment it has experienced

Carmel Mangan, Chris Hendy

Chemistry Department, University of Waikato

Reviewing this topic has revealed there are many who are confident about using stable isotope analyses as a method to determine occupancy and connectivity between habitats. Results from such studies are expected to compliment and support existing evidence of the diadromous (migratory) characteristics of fish.

Central to this idea is the fact that freshwater and marine environments are known to produce a characteristic isotopic signature that is either enriched or depleted in isotopes carbon-13 and oxygen-18. The signature reflects the chemistry of the water and its distinct isotopic composition. The isotopic composition of the fish otoliths (ear bones) has been found to store such information, and in this way preserve a record of the different conditions it has experienced over its life time, to the point of capture. Stable carbon and oxygen isotope analysis is proving its usefulness to reconstruct environmental histories, determine origins of fish and ultimately infer migratory behaviour.

Why does arsenic concentrate in organisms and lake sediments?

Alison Leslie

Chemistry Dept, Waikato University

Arsenic is found in many environments, including lake water, sediments, plant and animal tissue. The main sources of arsenic in the Waikato River are natural, from the geothermal fields of Wairakei, Ohaaki, Rotokawa and Orakeikorako, though some human augmentation occurs. There can be up to 0.033g m^{-3} (average 0.029g m^{-3}) in the river water at Ohakuri, though this drops to an average of 0.016g m^{-3} by the time the river reaches Tuakau and the Auckland water intake. Geothermal fields are the most common natural input of soluble arsenic into freshwater river and lake systems.

With a drop in concentration of almost 50% between peak arsenic concentration and the mouth of the Waikato River, arsenic must be deposited out of the system. Thus it ends chiefly in the sediments with the deposition of inorganic erosion products and organic debris. With the decay of organic matter, arsenic becomes locked into the sediments and pore waters. Lakes with geothermal inputs such as Rotorua often have high concentrations of arsenic in their sediments.

Arsenic is toxic to organisms but can only be taken into a cell by active transport as concentrations inside the cell are generally higher than in the surrounding environment, be this lake water or pore water. The process of active transport requires energy in the form of ATP (adenosine triphosphate). In oxidising environments arsenic occurs as arsenate (AsO_4^{3-} or As(V)) which competes with phosphate both for uptake channels and in the formation of ATP

forming instead ADP-As (adenosine diphosphate arsenate). Arsenic is found in reducing environments as arsenite (AsO_2^- or As(III)) this reacts with sulfhydryl groups causing the deactivation of proteins. Of the two inorganic forms, arsenite is the more toxic as reduction of arsenate to arsenite following absorption into cells is rapid. In addition, all forms of arsenic are considered to be carcinogenic.

How sulfur and oxygen isotopes can be used to identify acid mine drainage

Lisa Pearson

Chemistry Department, University of Waikato

The principal use of sulfur isotopes has been to understand the formation of sulfide ore deposits. The sulfur associated with sedimentary processes generally reflects the composition of biogenic sulfide produced by bacteria reduction of marine sulfate, and has negative $\delta^{34}\text{S}$ values. Sulfur associated with igneous rocks is isotopically similar to that of meteorites and has $\delta^{34}\text{S}$ values close to 0‰. Oxygen isotopes can be used to determine the origin of the water. Water that has evaporated or has mixed with evaporated water typically plots below the meteoric water line along lines that intersect the MWL at the location of the original un-evaporated composition of the water.

Under normal conditions, stable isotopes can define the conditions of pyrite oxidation such as its location above or below the water-table, the role of iron and sulfur-oxidizing bacteria, and the presence or absence of dissolved oxygen. Stable isotopes can highlight the important process of evaporation and mixing in determining the chemistry of acid mine drainage.

Development of an effluent plume from a wastewater treatment plant.

Kathleen Dabell¹ John Hadfield² Chris Hendy¹ Nick Kim²

¹ *Chemistry Department, University of Waikato, Private Bag 3105, Hamilton, New Zealand*

² *Environment Waikato Box 4010, Hamilton East, Hamilton, New Zealand*

Changes to the water treatment process at the Kinloch water treatment plant on the north western shores of Lake Taupo, has resulted in the formation of a new effluent plume down stream from the discharge point.

Discharge from the water treatment plant contained high levels of sodium, chloride, phosphorous, potassium and bicarbonate.

Changes in the concentrations of elements in the groundwater and discharge waters were monitored to determine groundwater changes due to the effluent discharge. Increases were seen in the concentrations of chloride, calcium and magnesium within six months of discharge commencing. Sodium and potassium concentrations were not seen to increase. Treatment processes at the Kinloch plant result in levels of nitrate in the discharge waters being lower than found in the background groundwater.

Chloride concentrations in the surrounding groundwater were seen to rise to levels similar to that in the discharge waters. These concentrations are used to determine the initial position of the effluent plume. The concentrations of calcium and magnesium in the groundwater samples collected were seen to increase to almost twice that of the discharge water. This increase is due to the rapid and complete cation exchange of the sodium at the plume front. Potassium and phosphorous are apparently still being absorbed by the pumice soils.